DOCUMENT RESUME

ED 443 407 IR 020 317

AUTHOR Chou, Huey-Wen
TITLE The Effects of Training Method and Individual Differences on Learning Performance and Computer Self-Efficacy in WWW Design Training.
PUB DATE 2000-04-25
NOTE 9p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 24-28, 2000).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; Behavior; Cognitive Style; Computer Literacy; Computer System Design; High Schools; Learning; Modeling (Psychology); *Self Efficacy; Sex Differences; Teaching Methods; Training; World Wide Web

ABSTRACT

This study compared the effects of two training methods--instruction-based and behavior modeling--on learners' computer self-efficacy and performance in World Wide Web home page design. A field experiment was conducted with two classes of 10th grade students. Results indicated that the behavior modeling training method yielded consistently superior performance and higher computer self-efficacy as compared with the instruction-based approach. However, results also showed that gender and learning style played critical roles in training method effectiveness. In terms of performance, results showed male students as benefiting more from the instruction-based approach and female students more from the behavior modeling conditions. For self-efficacy, results showed females gaining more from the instruction and males benefiting more from behavior modeling approaches. (Contains 40 references.) (AEF)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 443 407

The Effects of Training Method and Individual Differences on Learning Performance and Computer Self-Efficacy in WWW Design Training

Huey-Wen Chou
Department of Information Management
National Central University
#38, Wu-Chuan Li, Chungli, Taiwan 32054, ROC
E-mail: hwchou@im.mgt.ncu.edu.tw
Ph: +886-3-4267256
Fax: +886-3-4254604

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
- This document has been reproduced as received from the person or organization originating it.
  Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ABSTRACT

The present study compared the effects of two training methods on learner's computer self-efficacy and learning performance in WWW homepage design by a field experiment. The experiment was conducted using two classes of 10th graders. Results indicated that the behavior modeling training method yielded consistently superior performance and higher computer self-efficacy as compared with the instruction-based approach. Subjects with different learning styles performed substantially different in task 2. The significant two-way interaction indicates how critical roles that gender and learning style played in interacting with training method. For learning performance, male students benefited more from the instruction-based and female students learned better in the behavior modeling conditions. When concerning about computer self-efficacy, female gained more from the instruction and male benefited more from behavior modeling approaches. Each training method has its unique merit to meet designated training objectives for learners with specific traits. Future research directions conclude the paper.

Keywords: End-user training, training method, learning style, behavior modeling, self-efficacy.

INTRODUCTION

Computer training is considered as an essential contributor to the success of organizational computing, especially at the information age. With the increasing need for company employees to become more computer literate, projections indicate that IT training will exceed $18 billion dollars by the end of this century (International Data Corporation 1995). Information system managers have a concurrent need to ensure that end users acquire adequate computing skills in the most effective and efficient ways to assume their end-user roles. However, broad diversity of individual differences among potential trainees could call for one or the other training methods of instruction, e.g., how the end user processes information. Maier (1973) suggests that the result of training is a multiplicative product of an individual's ability, motivation levels, and training environment. Davis & Davis (1990) first explored the effects of training techniques and personal characteristics on training end users of information systems. They found that the appropriate training method depends on evaluation of one or more employee characteristics to select the most efficient and effective training technique, or a mix of those techniques. With solid knowledge about end-user training potential, educators or trainers can develop programs more suitable for individuals (Bostrom et al. 1990; Davis & Davis 1990; Sein et al. 1987).

Gender was introduced in this study because it may contribute to the understanding of

IR020317

BEST COPY AVAILABLE

self-efficacy exerted in improving the training benefits of computer skills (Rattanapian & Gibbs 1995, p. 60). Harrison and Rainer (1992) studied the influence of individual differences on end users computing skills. Data was collected from survey and the multiple regression analysis results suggested that individual difference variables, such as male gender, lower computer anxiety, etc., associated with computer skills and accounted for 56 percent of the variance associated with computer skill. Chou (1999) studied on the effects of learning style and training methods on computer attitude and learning performance. Results showed that prior achievement is a significant factor in predicting learning performance.

In the literature, computer anxiety and attitudes toward computers have often been found as the two critical factors influencing computer learning performance (Sein & Bostrom 1989; Amdt et al. 1985). Research has shown that work-related performance is associated with self-efficacy in learning and achievement (Campell & Hackett 1986). Gist et al. (1989, 1991) confirmed the same type of positive relationship existed. They also suggested that initial computer self-efficacy moderated the effect of training method on training outcome.

Three objectives are attempted in this paper. The first objective is to compare the relative effectiveness of instruction-based and behavior modeling training approaches with respect to learning performance and computer self-efficacy. The instruction-based treatment represents a deductive technique whereas the behavior-modeling condition employs an inductive approach. Developing a conceptual model to evaluate how training method and individual differences in gender and computer anxiety level influence learning performance and computer self-efficacy is the next to examine. Research in instructional psychology has demonstrated that adapting instructional methods and teaching strategies to accommodate key individual differences has led to improved performance (Snow 1986). The third objective then is to assess if individuals with different traits perform differently in two training conditions.

Hypothesis 1a: When measured on an objective and hands-on performance measure, there will be no significant differences in learning performance between the behavior modeling and the instruction-based training conditions.

Hypothesis 2a: There will be no significant gender differences in learning performance.

Hypothesis 3: Past achievement will not have significant effects on learning performance.

Hypothesis 4a: There will be no significant differences in learning performance between high and low pretraining computer anxiety groups.

Hypothesis 1b: There will be no significant differences in computer self-efficacy between the behavior modeling and the instruction-based training conditions.

Hypothesis 2b: There will be no gender differences in computer self-efficacy.

Hypothesis 4b: There will be no significant differences in computer self-efficacy between the high and low pretraining computer anxiety groups.

Research in instructional psychology has demonstrated that adapting instructional

methods and teaching strategies to accommodate key individual differences has led to improved performance (Snow 1986). Snow (1989) proposed that "learners differ profoundly in what they do in learning and in their success in any particular learning situation." (p. 14) The quotation focuses us to design instruction to accommodate individual uniqueness.

Hypothesis 5a: Participants with the same computer anxiety level will not develop significant differences in learning performance across training methods.

Hypothesis 5b: Participants with the same computer anxiety level will not develop significant differences in computer self-efficacy across training methods.

Hypothesis 6a: Participants with the same level of computer anxiety will not develop significant differences in learning performance across gender groups.

Hypothesis 6b: Participants with the same computer anxiety level will not develop significant differences in computer self-efficacy across gender groups.

Hypothesis 7a: Participants with the same gender will not develop significant differences in learning performance across training methods.

Hypothesis 7b: Participants with the same gender will not develop significant differences in computer self-efficacy across training methods.

Hypothesis 8a: Participants with the same gender and computer anxiety level will not develop significant differences in learning performance across training methods.

Hypothesis 8b: Participants with the same gender and computer anxiety level will not develop significant differences in computer self-efficacy across training methods.

CONCEPTUAL RESEARCH MODEL

The conceptual model including the following variables is derived as Figure 1.

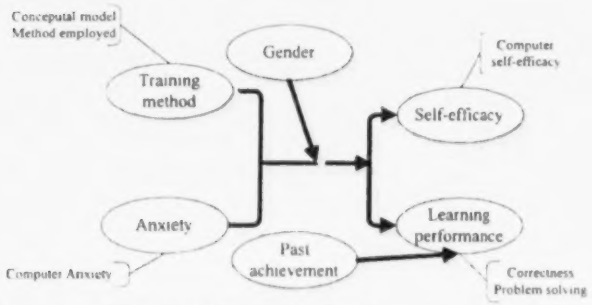

Figure 1. Conceptual research model.

1. **Gender**: which was suggested as one of the descriptive traits in Posner and McLeod's (1982) taxonomy on individual difference. Gender was proposed as a moderating variable that would moderate the effects of training method and computer anxiety on learning performance and computer self-efficacy.
2. **Training method**: which was adopted from Bostrom et al.'s theory and was manipulated into two levels: instruction-based and behavior modeling.

BEST COPY AVAILABLE

3. **Anxiety**: which was suggested as one of the states in Posner and McLeod's (1982) taxonomy on individual differences.
4. **Past achievement**: which was suggested as one of the descriptive traits in Posner and McLeod's (1982) taxonomy on individual difference. Past achievement was proposed as a covariate variable that would have effects on learning performance. The variable was indicated by last semester's mathematics grade.
5. **Self-efficacy**: which was adopted from Bandura (1986) and was indicated by computer self-efficacy.
6. **Learning performance**: which was adopted from Kirkpatrick (1994) and was indicated by correctness and problem solving.

METHODS

A field experiment was conducted to test the hypotheses. Gender, training method, and computer anxiety are treated as the independent variables. Data was collected from a private senior high school located in Chungli, Taiwan (ROC). Two tenth-grade classes were selected at random to attend 3-section training courses in WWW homepage design. The numbers of students sitting in these two classes are 53 and 55, respectively. Each class was randomly assigned to one of the two training methods: instruction-based and behavior modeling. 101 out of 108 subjects have successfully completed the entire training process. 92 out of them were valid data and were taken for statistical analysis. The two groups were comparable in terms of gender (approximately 52% female, 48% male) and prior achievement (t of .257 for last semester's math grade).

Three sets of training materials were developed based on a commercialized reference book for WWW homepage design (Horton et al. 1996). The first set provides the participants with WWW and HTML orientation, including introduction of Netscape Composer, primary attributes, and document background. The second set contains paragraph definition and image insertion. The final set includes hyperlink and table manipulation. To ensure that the main aspects of computer training are explored, this study combines both abstract knowledge (general concepts) and procedural knowledge during each training session.

The training course began with an introduction. All trainees were then given a computer anxiety scale (CAS), a pretraining computer self-efficacy (CSE) measure, and a background questionnaire. Three training sessions were held in the following three weeks. Each session lasted till every participant had completed the performance task. A posttraining computer self-efficacy test was given at the end of the third training session. The change between the computer self-efficacy pretraining and posttraining test scores indicates the computer self-efficacy change during the experiment. Several measures employed in the study include:

Learning Performance. Performance tests were self-developed to measure skill-based learning outcomes. The performance tests were task-oriented and were delivered at the end of training sessions. Participants were required to complete a task by applying whatever they learned from instruction.

Computer Self-efficacy. A measure of computer self-efficacy (CSE) originally developed by Murphy et al. (1989) was employed in the study. The scale was translated into Chinese and was pilot tested to make semantic changes.

Computer Anxiety. A Chinese version of the computer anxiety scale (CAS), translated from Marcoulides and Wang (1990), was available from literature and minor semantic changes were made by two experts to fit in participants' background. To ensure the validity, a pilot test was

conducted.

Past Achievement. The variable is indicated by the last semester's mathematics grade. This is a continuous variable ranged from 0 to 100.

ANALYSIS AND RESULTS

Reliability measures for computer anxiety, pretraining and posttraining computer self-efficacy measures, assessed by Cronbach α coefficients, were .9403, .9739, and .9237 respectively. ANCOVA and correlation analysis techniques were employed to analyze data.

The covariate was significant in determining task 1 and 2. Significant treatment effects on task 2 and computer self-efficacy suggests behavior modeling result in better performance and higher computer self-efficacy. Significant gender difference was found only in computer self-efficacy, although male students did get higher scores in both tasks. Either hypotheses 4a or 4b was not supported that indicated pretraining computer anxiety level was not an effective factor in determining learning performance and computer self-efficacy. Nevertheless, the significant correlation coefficients between it and tasks 1 and 2, and computer self-efficacy makes it remain an important variable in describing the study results.

The significant gender by treatment effect on both tasks suggests that female students learned more in behavior modeling and male benefited more from instruction. Regarding to computer self-efficacy, the combined effects of gender and training method on computer self-efficacy were significant. The situation was reversed for computer self-efficacy, i.e., female students preferred instruction condition whereas male students were more suited for behavior modeling condition. The significant computer anxiety by training method effects suggested that low computer anxiety students would get even less than those of high computer anxiety do in computer self-efficacy if given instruction-based training. The gender by computer anxiety effects showed that female and high computer anxious students would benefit the most among the four groups whereas their male counterparts would gain the least from the experiment.

The significant 3-way interaction effect suggests that gender, anxiety level did interact with training method and result in significant differences in learning.

CONCLUSIONS

The study provides some tentative answers to the questions posed earlier in the paper concerning end-user training. Several key issues pertaining to the design of training programs for computer learning were studied. A clear statement from the results of the study concerns the appropriate training method. While the behavior modeling method is superior with respect to learning performance and computer self-efficacy, the significant 3-wy interaction indicates how critical roles that gender and pretraining computer anxiety level played in interacting with training method. While for both tasks, male students benefited more and female students learned better from the instruction-based and behavior modeling respectively, female gained more from the instruction and male benefited more from behavior modeling approaches when concerning about computer self-efficacy.

This study, as most others, has limitation. The major limitation is the use of school students as convenient sample. This puts the study external validity on question. The scope of the study needs to be extended and replicated with real-world end users. Several practical and theoretical implications arise from these findings. First, additional training techniques need to be studied with different computer training contents, such as languages programming and application software. Another avenue of research is to explore and compare the effects of

different types of cognitive style. A match between trainer's and learner's cognitive style may worth examine.

REFERENCES

Amdt, S., J. Clevenger and L. Meiskey (1985). "Students' attitudes toward computers," Computers and the Social Sciences, 1(3-4), 181-190.

Bandura, A. (1986). Social Foundations of Thought and Action: A Social Cognitive Theory, Englewood Cliff: New Jersey: Prentice-Hall.

Bandura, A. (1969). Principles of Behavior Modification, Holt, Rinehart and Winston. New York.

Bostrom, R.P., L. Olfman, and M.K. Sein (1990). "The importance of learning style in end-user training," MIS Quarterly, 14(1), pp. 101-109.

Campell, N.K. and G. Hackett (1986). "The effects of mathematics task performance on math self-efficacy and task interest," Journal of Vocational Behavior, 28, pp. 149-162.

Cheney, P.H, R.I. Mann, and D.L. Amoroso (1986). "Organizational factors affecting the success of end-user computing," Journal of Management Information Systems, 3(1), pp. 66-80.

Chou, H.W. (1999). " The effects of learning style and training method on Computer attitude and performance in WWW page design training," Journal of Educational Computing Research, (forthcoming).

Christoph, R.T., G.A. Schoenfeld, Jr., and J.W. Tansky (1998). "Overcoming barriers to training utilizing technology: The influence of self-efficacy factors on multimedia-based training receptiveness," Human Resource Development Quarterly, 9(1), pp. 25-38.

Davis, S.A. ?? and R.P. Bostrom (1993). "Training end users: An experimental investigation of the roles of the computer interface and training methods," Management Information System Quarterly, 17, pp. 61-86.

Davis, D.L. and D.F. Davis (1990). "The effect of training techniques and personal characteristics on training end users of information systems," Journal of Management Information system, 7(2), pp. 93-110.

Gattiker, U.E. and D. Paulson (1987). "The quest for effective teaching methods: Achieving computer literacy for end-users," Information Systems and Operations Research (INFOR), 25(3), pp. 256-271.

Gist, M.E., C.K. Stevens, and A.G. Bavetta (1991). "Effects of self-efficacy and post training intervention on the acquisition and maintenance of complex interpersonal skills," Personnel Psychology, 44, pp. 837-861.

Gist, M. (1989). "The influence of training method on self efficacy and idea generation among managers," Personnel Psychology, 42(4), pp. 787-805.

Gist, M.E., C. Schwoerer, and B. Rosen (1989). "Effects of alternative training methods on self-efficacy and performance in computer software training," Journal of Applied Psychology, 74, pp. 884-891.

Hall, E.R. and J.S. Freda (1982). A comparison of individualized and conventional instruction in Navy technical training, (Training Analytical Evaluation Group Technical Report, No. 117). Orlando, FL: Naval Air Warfare Center, Training Systems Division.

Harrison, A.W. amd R.K. Rainer, Jr. (1992). "The influence of individual differences on skill in end-user computing," Journal of Management Information systems, 9(1), pp. 93-111.

Horton, W., L. Taylor, A. Ignacio, and N.L. Hoft (1996). "The Web Page Design Cookbook".

John Wiley & Sons, pp. 31-50.

International Data Corporation (1995).

Kernan, M.C. and G.S. Howard (1990). "Computer anxiety and computer attitudes: An investigation of construct and predictive validity issues," Educational and Psychological Measurement, 50, pp. 681-690.

Kirkpatrick, D.L. (1994). Evaluate Training Programs: the Four Levels, Berrett-Koehler.

Lewin, K. (1951). Field Theory in Social Science: Selected Theoretical Papers, Harper and Row. New York.

Maier, N.R.F. ((1973) Psychology in Industrial Organizations Houghton Mifflin, Boston, MA.

Marcoulides, G.A. and X.B Wang (1990). "A cross-cultural comparison of computer anxiety in college students," Journal of Educational Computing Research, 6(3), pp. 251-263.

Marcoulides, G.A. (1988). "The relationship between computer anxiety and computer achievement," Journal of Educational Computing Research, 4, pp. 151-158.

Mawhinney, C.H. and S.P. Saraswat (1991). "Personality type, computer anxiety and student performance," Journal of Computer Information Systems, 8, pp. 110-123.

Murphy, C.A., D. Coover, and S.V. Owen (1989). "Development and validation of the computer self-efficacy scale," Educational and Psychological Measurement, 49, pp. 893-899.

Nelson, R.R. and P.H. Cheney (1987). "Training end users: An exploratory study," MISQ, December, pp. 547-558.

Olfman, L and M. Mandviwalla (1994). "Conceptual versus procedural software training for graphical user interfaces: A longitudinal field experiment," MISQ, 18, 405-426.

Posner, M.I. and P. McLeod (1982). "Information processing models-In search of elementary operations," Annual Review of Psychology, (37), pp. 477-514.

Rattanapion, V. and W. Gibbs (1995). "Computerized drill and practice: Design options and learner characteristics," International Journal of Instructional Media, 22(1), pp. 59-77.

Saljo, R. (1981). "Learning approach and outcome: Some empirical observations," Instructional Science, 10(1), pp. 47-65.

Santhanam, R. And M.K. Sein (1994) "Improving end user proficiency effects of conceptual training and nature of interaction," Information Systems Research, 5, pp. 378-399.

Sein, M.K., and R.P. Bostrom (1989). "Individual differences and the training of novice users," Human-Computer Interface, 4(3), pp. 197-229.

Sein, M.K., R.P. Bostrom, and L. Olfman (1987). "Training end users to computers: Cognitive, motivational, and social issues," Information Systems and Operations Research (INFOR), 25(3), pp. 236-254.

Sein, M.K., R.P. Bostrom, and L. Olfman (1987). "Conceptual models in training novice users," Proceedings of INTERACT'87, Stuttgart, West Germany, pp. 861-867.

Simon, S.J., V. Grover, J.T.C. Teng, and K. Whitcomb (1996). "The relationship of information system training methods and cognitive ability to end-user satisfaction, comprehension, and skill transfer: A longitudinal field study," Information Systems Research, 7(4), pp. 466-490.

Simon, S.J. and J.M. Werner (1996). "Computer training through behavior modeling, self-paced, and instructional approaches: A field experiment," Journal of Applied Psychology, 81(6), pp. 648-659.

BEST COPY AVAILABLE

Snow, R.E. (1986). "Individual differences in the design of educational programs. "American Psychologist, 41(10), pp. 1029-1039.

Snow, R.E. (1989). "Aptitude-treatment interaction as a framework for research on individual differences in learning," In P.L. Ackerman, R.J. Sternberg, and R. Glaser (Eds.) Learning and Individual Differences, (pp. 13-59), New York: Freeman.

Szajna, B. and J.M. Mackay (1995). "Predictors of learning performance in a computer -user training environment: A path-analytic study," International Journal of Human-Computer Interaction, 7(2), pp. 167-185.